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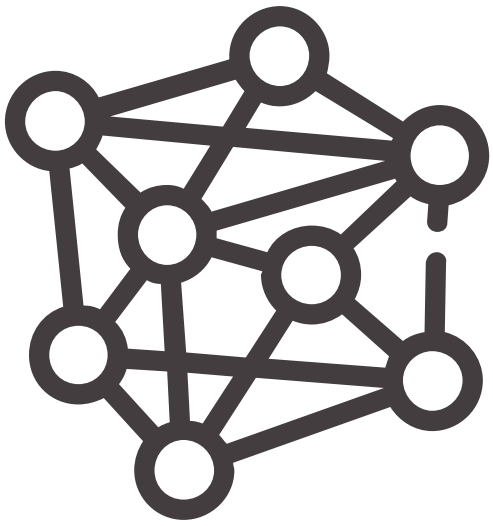
Public Safety Mobile Broadband Consultation - Productivity Commission - May 2015



Rev B

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Re: Public Safety Mobile Broadband – Productivity Commission Issues Paper – May 2015

Ericsson Australia welcomes the opportunity to respond to the Productivity Commission.

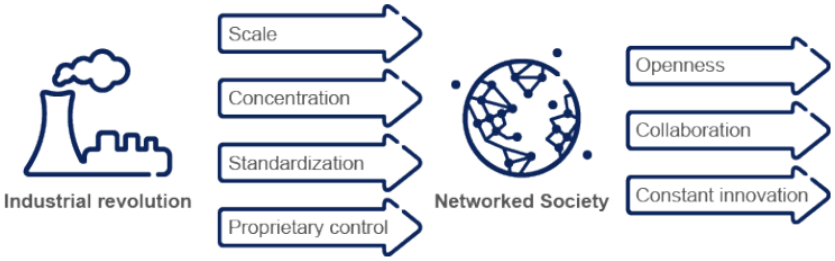
Key Ericsson perspectives

There is little question that technology has the potential to fundamentally transform how we organize our lives, businesses and societies. But only recently have some of the most powerful technologies ever created become intensely personal – they are now embedded not just into our mobile devices and cloud software, but into our everyday expressions, interactions, relationships and exchanges. The result is an unprecedented capacity for individual empowerment, entrepreneurship and innovation.

As these digital infrastructures and interactions become increasingly central to the functioning of our societies and economies, it is in everyone's interest to understand their potential and ensure their integrity.

Most business offerings today consist of a product or service. A technology platform, by contrast, makes it possible to provide a function, a network of relationships or a completely new marketplace for one's own products and services, and those of others. By opening up entire business processes to other stakeholders, the platform serves as the technological base upon which customers, developers, businesses and their partners can build added value through increased participation.

Wherever a platform emerges as a business-critical infrastructure for a wide range of other businesses, it not only reduces transaction costs for various business and peer-to-peer functions, but becomes an economic force with logic of its own.[1]



[1] Ericsson, Understanding the Networked Society, Feb 2015

About Ericsson

Ericsson is the world's leading provider of technology and services to telecom operators, and is the global market leader in IPTV, satellite and contribution & distribution compression. Ericsson is the leader in 2G, 3G and 4G mobile technologies as well as a founding member and coordinator of the 5G standardization initiative *Mobile and wireless communications Enablers for the Twenty-twenty Information Society (M*ETIS). Further, Ericsson provides support for operators that collectively serve over 2.5 billion subscribers and has the leading position in the telecoms managed services business domain.

The company's portfolio comprises of mobile and fixed infrastructure, telecom services, software, broadband and multimedia solutions (including IPTV and Mobile TV) for operators, enterprises and the media and broadcasting industry.

As the world's leading network infrastructure and managed services provider for mobile network operators, Ericsson plays a key role in the development of standards for mobile telephony and mobile broadband technologies, and seeks to ensure a globally harmonised allocation of spectrum to foster a global ecosystem of network infrastructure, handsets, and other devices to benefit enterprises and consumers.

Ericsson has one of the industry's strongest telecom technology portfolios, with around 35,000 granted patents worldwide and is the leading patent holder for 3GSM family of mobile network equipment standards: GSM (2G), UMTS / WCDMA (3G) / LTE (4G). Ericsson is the leading vendor in supplying LTE equipment to mobile operators around the world, and is a net receiver of licensing royalties with more than 90 patent-licensing agreements in place.

Ericsson is the fifth largest Information Technology Company by software revenues, following Microsoft, IBM, Oracle and SAP. Ericsson employs over 118,000 staff worldwide and over 25,000 of those are dedicated to research and development (R&D). Ericsson invested USD 5 billion in R&D in 2014.

Ericsson makes its technology available to others, and is a champion of industry practice on FRAND (Fair, Reasonable and Non-Discriminatory) licensing.

In agreement and in support of telecommunication developments, the Department of Communications as well as Government authorities around the world play a significant role in maximizing the societal benefits of convergence and in creating incentives for industrial and societal transformation toward a digital networked society.

Ericsson has been an active industry participant in Australia since the 1950s, and currently has a strong presence of around 1100 employees, delivering high-value professional services capability across Australia, New Zealand and the Asia Pacific region.

Ericsson Australia responses:

1 What is the merit (or otherwise) of the proposed approach to undertaking first principles analysis in this study?

An independent, fact-based approach will provide clear options, benefits and risks prior to making any policy or implementation recommendations. As there is often tangible cross-industry and social benefits with ICT investments, these should be considered as part of the analysis. For example, a faster ambulance response time may reduce severity of injury to a patient, and therefore potentially reduce the recovery time (and cost) in hospital.

2 What domestic or international developments, reports or experiences in PSMB (or related matters) are relevant to consider in this study?

The growth of mobile broadband adoption and rates of data growth for consumer and enterprise services is often under-estimated. This is because the use of broadband services grows exponentially as new applications and services are offered; this is the benefit of the Internet with a global addressable market. There is no reason to expect that Public Safety Agencies will differ – as they are likely to also underestimate their future mobile broadband growth needs, considering many applications and use-cases are not yet known.

Learnings can potentially be gained from other Public Safety Mobile Broadband (PSMB) assessments, deployments and procurement processes already underway including (not exhaustive):

a USA National Deployment First governed by BDOD and later migrated to FirstNet – private deployment with roaming

b UK Home Office: Operator provided and Shared

c Canada

d Oman

e South Korea

Furthermore, these country initiatives have identified the importance of having a clear and workable governance model where multiple states and numerous agencies are subscribers/consumers of these services. In fact, this has found to be equally important as the technology.

Additionally, Ericsson has worked together with Telstra in Australia to develop the LANES network capability which is designed to provide an optimised PSMB capability.

According to ITU[2] Recommendation M.2291-0, LTE systems are well suited for PSA's when compared to traditional systems, and provide 'unprecedented capabilities for public safety'. Examples include:

- Better performance, leading to improved situational awareness - through use of MIMO, OFDMA, high-power devices (UE's), enabling very high volumes of information to be rapidly exchanged and shared by field and operations staff.
- Simplified, IP-based architecture, enabling unified communications and enhanced operations - through lower capital and operational expenditure and latency. Further, all-IP simplifies interoperation of network elements and services, including commercial applications as required.
- Low latency and packet loss, enabling high-quality streaming video - through an architecture that is designed to increase simplicity of operation and reduce latency, enabling all operatives to see clearly what's happening at an incident site.
- Greater interoperability, enabling:
  - lower-cost standardized solution and devices
  - roaming onto commercial networks
  - seamless communications between other responders
  - leveraging vast amounts of situational awareness information
- Improved security
- Network sharing
- Quality of service & prioritization
- Bandwidth flexibility
- Simultaneous use of multiple applications and grade of service
- Enhanced spectrum efficiency

Other reports that should be considered in the context of this consultation include:

- ITU recommendations on frequency arrangements for PPDR[3], which recommends 806 824/851-869 MHz in some countries in Region 3
- ITU recommendations on radio interface standards for use by PPDR[4]

[2] ITU-R M.2291-0 (12/2013), The use of International Mobile Telecommunications for broadband public protection and disaster relief applications

[3] ITU-R M.2015 (03/2012) Frequency arrangements for public protection and disaster relief radiocommunication systems in UHF bands in accordance with Resolution 646 (Rev.WRC-12)

3 What are the implications (if any) of the Australian Government's review of the spectrum policy and management framework, and ACMA's ongoing work on spectrum allocation matters, for the delivery of PSMB in Australia?

The quantum of spectrum allocated should take into account the specific use-cases and services defined for PSMB, and their respective growth over time, as described in the response to Question 2 above.

This is, of course, in addition to the assumptions around cell/grid density, number of concurrent users and 'busy hour' events to be defined.

4 Are there any other PSAs that should be considered within scope in this study? To what extent are communications between PSAs and the community relevant to this study?

This matter should be referred to the PSAs, however in Ericsson's experience there are a number of volunteer based agencies which are frequently utilized in times of natural disasters and as first-responders in remote areas. Some of these (non-exhaustive) include:

- State Emergency Services (SES)
- Life Saving Australia
- Local Government

It is increasingly common to see second responders involved during an incident response. Some of these (non-exhaustive) include:

- Electricity Distributors
- Gas Distributors
- Roads management Agencies (Main roads or Local Council)

Often, energy distributors are part of command-centres in large events and may also be involved in the management of minor incidents where power or gas is affected. They are often part of the co-ordination in managing sub-station shutdown and recovery in times of natural disasters and removing power where minor incidents may require intervention.

With regard to communications between the PSA's and the community, this is becoming increasingly important in times of disaster. This is of particular importance in allowing the PSA's to advise community safety aspects, and even more importantly as part of the information gathering systems. As in many cases, it is data on 'social media' that provides an additional information stream and perspectives to incident commanders on how to respond, becoming part of agency business operating procedures.

[4] ITU-R M.2009, (03/2012), Radio interface standards for use by public protection and disaster relief operations in some parts of the UHF band in accordance with Resolution 646 (WRC-03)

This requirement should be factored into shared PSMB scenarios - where public mobile carriers may need to prioritise a defined amount of capacity on their networks for PSA's use, balanced against the ongoing communication needs of the general public.

5 How do the organisational and institutional arrangements for PSAs vary between the Australian jurisdictions? What implications (if any) does this have for the way in which PSAs procure, operate and use communications services?

The arrangements vary widely between agencies, however the states are increasingly looking to move towards an overarching and managing organisation responsible for governance and communications systems procurement negotiations, which are then provided 'as-a-service' to agencies, irrespective of funding arrangements. Examples include: NSW Telco Authority, Emergency Management Victoria / Emergency Services Telco Authority.

International PSMB programs have proved that consideration for the varying state arrangements is important in determining an over-arching governance organisation with responsibility for managing the PSMB solution and partner contracts - whether private, shared, or provided by public mobile operators.

The implications for procurement include possible reduction in the duplication of procurement effort through consolidated requirements and purchasing/negotiation power with suppliers. Further, the risk of interoperability challenges between different states and agencies often caused by procurement occurring at differing stages of technology refresh cycles is greatly reduced.

6 What is an appropriate definition of 'mission critical' communication systems and capability for the purposes of this study? What metrics should be used to assess whether capability is being delivered to adequate levels during mission critical circumstances? What evidence is there that existing capabilities are satisfactory or unsatisfactory?

Definitions of 'mission critical' will be available from documents developed by the TCCA and P-25TIG organisations. There will also be various definitions from within the PSA's themselves.

Ericsson recommends the Productivity Commission achieves consensus early on with regard to a single definition to be applied to all PSMB considerations, taking into account the general definitions by TCCA and P25 and those provided by the agencies themselves. This will help govern the determination of whether existing systems can meet the desired performance based on that commonly agreed definition. It is likely to include elements of the following:

- Availability / Accessibility Up time (Redundancy level)
- Specifically in times of lost environmental(s), such as mains power
- Recoverability – Time to recover

7 What applications do PSAs currently use on their LMR networks that are provided for mission critical purposes? Does this differ by jurisdiction?

No comment.

Note: Ericsson understands that PSA's have mission-critical applications for voice, basic job dispatch and vehicle location using narrow-band data.

8 How often are PSA narrowband networks (such as LMR networks) renewed or upgraded, and to what extent are different jurisdictions at different points in this process? What are the costs involved in maintaining these networks?

Frequency of PSA narrowband renewals or upgrades varies, but in general tends to be in the range of 7 to 10 years. Within this period however, there are ongoing adjustments and augmentations which are driven by operational demands such as changes in capacity or coverage needs, as well as life cycle management requirements.

With respect to different jurisdictions, buying cycles vary considerably and this is best confirmed by the agencies themselves.

9 How do the different types of events that PSAs deal with affect their demand for communications capabilities? Can you provide examples or evidence to illustrate this?

This question is best answered by PSA's themselves, however as an observer Ericsson notes that each agency will have very different requirements – even for a single incident, which must be factored into demand calculations.

Referring to the response to Question 2, it is a challenge for PSA's to forecast future service usage demand for applications, products and use-cases which are yet to be defined and developed.

10 How, and to what extent, are PSAs using mobile broadband capability provided over commercial networks, and related products and applications, to support their operational activities? Are there any lessons or insights from these experiences, including the benefits that are being realised?

Ericsson recommends seeking feedback directly from PSAs.

Ericsson notes, however, that many PSA's utilize commercial networks already today for mobile broadband capability, with applications including job dispatch, mobile office applications and video streaming. However, many are considered 'secondary' systems with mission critical voice always considered the primary application in times of an incident or disaster.

11 How do other large organisations (such as government and corporate organisations with certain requirements which may be similar to those of PSAs) currently use mobile broadband services provided on commercial networks?

Examples include:

- The UK Home Office have commenced a tender process, seeking an operator to provide such a service
- USA FirstNet building out private networks
- South Korea at very early stage of tender process
- Canada considering to both leverage and align with the energy sector, which can utilize day-to-day capacity but prioritize PSA's in time of an emergency or incident

Additionally, many industry sectors make use of mobile broadband to enable business critical applications orientated towards greater business efficiency. These include utilities, the mining sector, agriculture, banking, amongst others.

12 What lessons or insights can be taken from the previous trials of Telstra's LANES model, including during the G20 summit in November 2014?

As a partner to Telstra for delivery of the solution and support services to enable the LANES trial during the G20 summit in November 2014, Ericsson observed the following:

- Telstra's LANES network offered a consistent performance and exceeded minimum performance requirements
- There was minimal congestion observed on both the commercial and LANES networks, within the trial area
- Numerous valuable insights and learnings were gained from the trial, for Telstra, Ericsson and the involved PSA's
- Network architecture and capabilities must be understood and configured optimally in order to deliver the required outcomes for specific user groups
- In addition to network capability, supporting IT systems must be considered to enable subscription and policy management of end users

13 Can commercial network solutions that involve dedicated spectrum for PSAs (and prioritised capacity in other spectrum bands during emergency incidents) allow for interoperability between networks operated by other mobile carriers and/or for end user to roam across multiple networks? Are there any technical, institutional or commercial barriers that would prevent this outcome?

Yes, commercial network solutions that involve dedicated spectrum for PSA's can allow for interop between networks operated by other mobile carriers and/or for end users to roam across multiple networks.

There are a number of ways this can be performed with the final solution dependent on operational requirements. One of many possible examples includes: roaming to another operator's network when the primary network is lost. However, key questions to consider include:

a what operational parameters determine when that subscriber should disconnect or be disconnected from the roaming network to determine if the primary network is again accessible?

b what priority configuration is to be passed to the roaming networks to be handled by their policy controllers?

From Ericsson's global perspective of commercial networks and involvement in defining future LTE technology specifications, there are no technical barriers that are insurmountable to prevent this functionality. Often the final technical requirements will be driven by the operational and associated commercial requirements /negotiation.

14 What applications could PSAs use if they had access to PSMB capability? How could this be expected to vary across PSAs?

Applications can be generally considered as independent of network functionality, and operate through API's. There is virtually no limitation to application support per se.

As outlined in the response to Question 2, many of the applications that will be of vital interest to PSA's are yet to be developed or made available in Australia. The primary drivers for PSMB today are video streaming and location services – but also include patient record/history and other critical database and search functions in addition to situational awareness information access.

However, as experienced in the commercial mobile operator industry, many new applications are likely to emerge once the service is available, further increasing data demands in the future.

15 To what extent could these applications replace or supplement the capability and systems currently used by PSAs on their narrowband networks?

Ericsson recommends seeking feedback directly from PSAs.

Ericsson notes, however that access to increased data speeds and situational awareness has the potential to improve PSA operator safety through pre-emptive search capabilities and improved operator productivity by providing greater levels of information to attending agencies, thereby reducing the need for officers to return to fixed locations.

16 How important are communications between PSAs and the community during emergency incidents?

Ericsson recommends seeking feedback directly from PSAs.

From Ericsson's experience, the importance of bi-directional communication between PSA's and the community continues to increase. In Australia, there has been substantial investment into community alert systems, including mobile networks. With the emergence of social media, many agencies have integrated this feed into business operating procedures as it provides a rich source of situational awareness data during incidents. A balance between the mission critical needs of PSAs and the community's emergency communication needs can be achieved through the application of network policies.

17 What PSMB capability characteristics should be considered in this study?

Key PSMB capability characteristics for consideration include:

- On demand overflow capacity to support high need events which require more capacity than is normally available to PSAs. This would include load balancing between different bands of spectrum; some of which may be dedicated to PSAs and some normally allocated to commercial users.
- Quality of Service (QoS) controls which provide prioritisation between members of the PSA community and for shared networks, between the PSAs and community users. QoS controls should also have the ability to differentiate between types of application. E.g. Prioritise PTT(IP based Push To Talk) over streaming video. Ideally, network priority policies could be adjusted dynamically based on situation needs.
- Network hardening to improve resiliency during times of emergency.
- Priority access. During times of emergency and potential resulting network congestion (regardless of a shared or dedicated network), prioritized PSA users should be able to connect and access network services.
- Dependency on appropriate backhaul (for both dedicated and public networks)
- Potential benefit of NBN if able to be leveraged
- Uplink capacity of equal importance to downlink capacity – since some PSA applications rely on video uplink from the field, providing situational awareness. Provision of uplink capacity may be equal or even more important than download capacity. LTE native capabilities such as LTE Broadcast may help to smooth download demand.

18 How should 'national interoperability' be interpreted in this study? Does it include interoperability between networks, devices and applications used by PSA in different jurisdictions? Does it extend to integrating communications services between different local PSAs (for example, police, fire, ambulance and other responders)?

With a national, single spectrum band allocated today, there is no technical limitation to the 'national interoperability' extending to all jurisdictions and all emergency service providers. Depending on the outcome of this analysis, this may also need to include mobile operator interoperability – since PSA devices will need to support spectrum bands used by commercial networks in the event that roaming to mobile public networks is required.

It is expected that interoperability between PSA's will increase over time, and so it is recommended that all requirements should be incorporated into the target solution.

It is also recommended that PSMB networks be based on globally recognized and widely adopted mobile broadband standards such as LTE and its evolution through the 3GPP standards process. This will ensure interoperability between commercial operator networks and private PSA PSMB networks, and result in lower infrastructure and end-user device costs.

19 Does delivering a PSMB capability raise any new opportunities for achieving national interoperability?

This opportunity offers the first real capability for true interoperability. The existing LMR networks have had some limited interoperable features, however, the equipment choices and facilities selected by the various jurisdictions have limited the degree of success for interoperability. With a proposed PSMB network, the universal alignment in spectrum and technology choice creates a unique opportunity to provide for interoperability.

It should be noted, however, that although the technical capability for interoperability may be addressed, it will still be necessary for the agencies themselves to develop processes and procedures to enable inter-agency interoperability.

20 Would the benefits, costs and risks of achieving national interoperability vary under different deployment options? If so, how?

Different deployment options will drive variations in benefits, costs and risks.

Based on current models for PSA LMR deployment which is state-government based and funded, operational and interoperability requirements with other states are likely to be a secondary consideration.

Other countries are addressing this by seeking to incorporate an overarching governance body to ensure interoperability and a deployment by individual jurisdictions is in accordance with the common good and objectives of a national interoperable capability.

21 What progress has been made in putting in place arrangements to better coordinate emergency communications within and across PSAs and jurisdictions?

Ericsson recommends seeking feedback directly from PSAs, since this varies widely between PSA's and jurisdictions.

22 What level of network coverage do the existing networks used by PSAs (for narrowband voice and low-speed data capability) currently provide? How does this vary across jurisdictions?

Ericsson recommends seeking feedback directly from PSAs, since this varies widely between PSA's and jurisdictions.

23 What level of mobile broadband network coverage do PSAs require across metropolitan and regional Australia? Does this vary for different PSAs?

Ericsson recommends seeking feedback directly from PSAs, since this varies widely between PSA's and jurisdictions.

24 What is the most appropriate measure of network coverage for use in this study?

Mobile broadband coverage is typically measured via a defined minimum target data throughput achieved on both the uplink and downlink. In the case of PSAs, this minimum rate would be linked to the needs of nominated mission critical applications. For example, mission critical voice requiring a few kbps of data may achieve greater coverage from a given base station site than video requiring Mbps of data.

25 What options are there for extending the mobile coverage of commercial networks?

Commercial network coverage may be extended using the following approaches (individually or in combination):

- Building new base station sites in areas with no existing coverage
- Using lower frequency spectrum bands that propagate further than higher frequency bands
- Using higher transmit power and / or higher gain antennas on base stations and devices
- Using techniques such as transmit and receive diversity
- Making temporary base stations available for emergencies (COW - cell on wheels) which may be backhauled by microwave or satellite links.
- Facilitating roaming between compatible mobile broadband networks with complimentary coverage.
- Utilising small cell technology for in-building or in-fill network requirements.

26 Would the benefits, costs and risks associated with achieving an acceptable level of network coverage for PSAs vary under different deployment options? If so, how? And with what operational consequences?

Yes, benefits, costs, risks and operational requirements would vary significantly depending on different deployment options. In order to provide a detailed set of comments, specific deployment scenarios and assumptions would have to be clearly defined.

27 How could voice services — traditionally carried on narrowband networks — be integrated into a mobile broadband network capability? What challenges and risks need to be accounted for? Are the challenges at the local level (due to legacy factors) greater than those at the national level?

Currently, voice services can be delivered 'over the top' through vendor applications that provide 'push to talk' functionality on smartphones or other dedicated user devices. Such solutions can also interwork with current narrowband voice networks through server gateways and network interfaces (e.g. ISSI for P25). Using existing LTE capabilities, priority can be provided between PSA users and between applications (e.g. giving priority to voice over other applications). Existing LTE capabilities may also provide network access priority for specified users in time of congestion associated with emergencies.

Today, this approach is considered suitable for non-mission critical agency use-cases and is being trialled or used by agencies to supplement their narrowband network capacity or coverage.

The main challenge which prevents these applications delivered over commercial mobile broadband networks from being considered by PSA's for mission-critical applications today is the inability to operate in simplex / direct mode. For example, current narrowband terminals enable an officer to communicate with other officers in the vicinity to and thereby provide operational safety, even if connectivity to the local network is lost.

In addition to being able to operate PTT applications for voice on mobile broadband networks, the perceived 'mission critical deficiencies' are now being addressed through functionality within LTE Releases 12 and 13. These changes provide further LTE improvements for Group Communications and Proximity Services (ProSe), including the ability for direct terminal-to-terminal communications in the event of loss of network. These planned changes will also leverage the broadcast capability of the LTE networks for Group Communications capabilities.

The full list of these agreed (Release 12[5]) and future features (Release 13[6]) are available from 3GPP.

28 What challenges or opportunities arise (from a technical, institutional and/or commercial perspective) from such integration, and would the benefits, costs and risks vary under different options for PSMB? If so, how?

For a technical perspective, refer to response to Question 27.

[5] 3GPP Release 12 specifications
[6] 3GPP Release 13 specifications

From a commercial perspective, in the event of PSMB being provided by public mobile operators, the ability to leverage these features will depend on the operators choosing to deploy them across their network and the commercial arrangements that are required in order to utilize these features.

29 The Commission understands that there is currently work underway to develop voice applications for 4G/LTE networks for use in mission critical circumstances. When are these applications likely to become available?

Refer to response to Question 27. Applications for non-mission critical are already in use today. Release 12 functionality was confirmed late 2014, with commercial product availability expected 18-24 months later (i.e. late 2016) Release 13 functionality is due to be finalized and locked during 2016, again with commercial availability some 18-24 months later (ie during 2018).

30 What factors are important in ensuring the integrity and security of communications for PSAs? To what extent does this differ for different types of PSAs?

No comment.

31 Would the costs and risks associated with ensuring the integrity and security of communications differ depending on how a PSMB capability is delivered? If so, how?

No, costs and risks would not differ so long as SIM card administration and distribution is managed with the same level of rigour. Network security mechanisms are identical, and the ability to utilize application level security over the top is also identical.

32 What methods or metrics could be used to define and/or measure the level of security provided over a network that delivers mobile broadband capability?

This would be the same methods/metrics as applicable for securing of any IP-based network.

33 What additional security needs do PSAs have compared to other sectors with high security requirements for their communications?

No comment.

34 How should PSA demand for mobile broadband capability be estimated in this study, including their expected demand requirements into the future?

Ericsson recommends seeking feedback directly from PSAs.

However, Ericsson notes that actual demand for mobile broadband traffic often exceeds demand forecasts due to the introduction of new applications and services that were simply not anticipated by operators.

35 What methods or metrics could be used to define and/or measure the level of service capacity provided to PSAs?

Ericsson recommends the standard practice of capacity forecasting and usage reporting in order to define the level of service capacity required, and which is an ongoing process. Today, mobile operators are able to monitor data / service usage down to an individual subscriber level, so similar capability should be employed to ensure sufficient capacity is available to meet future demand.

36 What level of capacity will PSAs need for a PSMB capability, and how will this differ between business as usual activities and large scale emergency incidents?

Ericsson recommends seeking feedback directly from PSAs.

Ericsson notes that capacity required for PSMB capability will be driven by defined use-cases, and that predicted traffic demands are often exceeded due to unforseen application adoption once capability is available.

37 How might the demand for PSMB capability differ between types of PSAs? How could competing demands amongst PSAs be managed? Should particular uses be prioritised?

Technology wise this can be handled through prioritisation based on subscriber type (i.e. Agency), incident type, incident role, application type etc. However reaching agreement between agencies as to the application of different priority levels for different agencies is something that will need to be agreed and will be dependent on a strong PSMB governance body able to negotiate these business operating processes.

38 How would the benefits, costs and risks of ensuring sufficient capacity vary under different deployment options?

No comment

39 What level of resilience do PSA narrowband networks usually provide and how does this differ from commercial mobile broadband networks?

Ericsson recommends seeking feedback directly from PSAs.

In Ericsson's experience, as a manager of PSA networks, resilience will vary depending on the general accessibility and operational importance of individual sites. Sites considered as difficult to access in adverse conditions, during or after an incident may be built to operate from 2 to 5 days on a generator or battery backup, whereas those in more metropolitan/accessible locations are configured to operate between 12 to 48 hours on backup power sources. Depending on the operational importance of a site (eg high population coverage or a central hub for other sites), there may also be redundant backhaul deployed to further increase resilience. These aspects are determined on a case by case basis during network design.

40 What methods or metrics could be used to define and/or measure the level of resilience provided by the networks used to deliver PSMB?

Resilience can be defined / measured by:

- Site availability (subscriber attempts to access vs. success or OSS monitoring for no fault conditions)
- Site alternate power operating time (non-mains, generator, wind, battery, etc)

Appropriate OSS systems including a performance management solution will provide the capability for monitoring network resilience and availability.

41 What priority should be given to the capacity to stand up a replacement service within a specified timeframe in the event of a physical or network based disruption?

Recoverability is generally related to a service offering and aligned agreement to supply a particular level of support – be it internal department, external operator or solution provider/supplier. Of course, recoverability must be also supported with appropriately defined tools and capabilities, which may include portable 'cells on wheels' or similar rapid-deployment communications options.

42 Are there any barriers (for example, institutional, informational and/or technological) to, or challenges associated with, delivering a resilient PSMB capability? How might this differ between different deployment options?

Major barriers include commercial and financial alignment – both of which may impact the level of resilience that is able to be provided within a particular budgetary envelope. There is perception that mobile operator networks are not built to be 'as resilient' as current narrowband PSA networks, however there is no technical limitation that prevents such alignment. Operators may be open to increasing the level of power backup and backhaul redundancy within their commercial networks, based on agreed Service Level Agreements (SLA's), backed by commercial alignment.

43 How could future developments in technology, or growth in demand for mobile broadband services and capacity, affect the sustainability of PSMB capability under different deployment options?

Ongoing global standardization of 3GPP technologies (GSM/WCDMA/LTE/5G) and integration of relevant features for current 4G and future 5G technologies, as well as backward-compatibility are hallmarks of this global suite of wireless communication standards.

Finally, backwards-compatibility of technology combined with stringent SLAs and KPI's are used to guarantee lifecycle requirements for operators.

Commercial mobile operator business models are based on continual evolution of their installed network technology and feature capabilities, in line with technology advancements and software updates, to meet evolving demands of their end-customers. This ongoing investment is funded through a stable and increasing revenue base. Similarly, PSA's can benefit from future evolution in technology standards and features, however this is an ongoing operational cost – beyond the initial network investment – that must be planned for and funded.

44 How will the convergence of voice and data services affect the sustainability of PSMB capability under different deployment options?

Convergence of voice and data services into an all-IP domain within current 4G and future 5G networks will result in simplification of service availability across a wide-range of end-user devices. Furthermore, having a single bearer (IP-based) for all services will allow for much greater levels of service innovation across multiple platforms, and more cost-effectively, than ever before.

45 What challenges are involved with delivering a mobile broadband capability to PSAs by 2020? Do these differ under alternative deployment options?

Ericsson doesn't foresee any specific technology challenges with delivering mobile broadband capability to PSA's by 2020. Full mission-critical voice services and required network features are expected to be commercially available after 3GPP release 13, within the 2018-2020 timeframe.

46 What potential obstacles exist to a mobile broadband network being fully compatible with a range of end-user devices? Does this depend on the network deployment option?

Ericsson's approach to network infrastructure and services is based on global scale and technology harmonization across markets. The availability of highly-advanced smart phones that support a virtually unlimited set of services through app-based service deployment, at very affordable price points is due to the large economies of scale created through global addressable markets for device manufacturers.

Utilization of globally harmonized devices (as opposed to specialized, custom-built devices) will reduce the investment required by PSAs, as well as ensure that updated and new applications can be readily deployed to virtually all devices, with a minimum level of effort or operating cost.

47 How does the method of ensuring interoperability impact on the cost of the system to PSAs?

Ensuring interoperability should not have a major cost impact on a specific system selection or design. It should be noted, however that temporarily increasing PSA capacity through use of in-house or 3rd party (i.e. mobile operator provided) mobile broadband overflow or Cell on Wheels deployment, may have associated costs that must be taken into consideration – especially if the additional capacity is required for an extended period of time, such as during or after a major incident.

48 What detailed options should be evaluated in this study? What underlying assumptions and key parameters would be associated with each option?

Ericsson agrees with the options under consideration by the Productivity Commission, namely: 1) deploying a dedicated PSMB network, 2) an approach that is fully reliant on commercial networks, and/or 3) a combination of the two.

In addition to the considerations and assumptions identified in the consultation paper on p16-17, additional considerations that Ericsson suggests be addressed include:

- PSMB application and service definitions and characteristics
- Service use-case definitions and traffic demands
- The extent and degree of interoperability defined between PSAs
- Organizational change capability for delivering PSMB capability
- Device strategy to be employed for access to PSMB services
- Commercial considerations and challenges to be overcome

49 What (if any) assumptions or parameters should be 'common' across all options?

All of the considerations above, with the exception of commercial considerations, are 'common' across all options.

50 What are the sources of costs relevant to this study?

Key cost drivers include:

- Tower
- Radio base station, antennas & 'plumbing'
- Spectrum
- Power
- Backhaul transmission
- Core network

- Lifecycle upgrades and software features
- Operational costs – running the network, monitoring, alarm and fault handling, upgrades etc.
- Devices
- Applications

51 In what ways could delivering a PSMB capability affect non PSA users? How would these effects differ across deployment options? What methods could be used to estimate these effects?

General public (i.e. non-PSA users) already provide a valuable source of situational awareness and insight that is leveraged by many PSA's and integrated into their business operating procedures.

A deployment option that prioritizes PSA users' traffic over non-PSA users may inadvertently and significantly reduce this source of situational awareness. The impact of such an effect would require gathering of further insights directly from the PSA's themselves, and the level of benefit social media feeds actually provide to operations.

As spectrum and network capacity is always finite, regardless of network type (dedicated/commercial/combination) it will be necessary to balance the needs of PSA users and the general community in an emergency environment via the application of network priority policies. Such policies can ensure that PSA users get priority access to commercial bands for roaming or capacity overflow, while still allowing general community users to access reasonable bandwidth to meet their service requirements.

52 Is it appropriate to consider option values as part of the cost benefit analysis in this study? If so, how? What information or data is relevant?

A possible consideration with respect to 'option values' is to consider a phased introduction of PSMB. This may be achieved, without major capital investment, by leveraging public mobile infrastructure with appropriate PSMB capability enabled. Such an approach would enable the phased introduction, over time, of specific use cases and organizational support and operating procedures required to leverage the PSMB capability. Importantly, any early learnings from such a phased introduction would act to accelerate the future deployment to other PSA's, as well as better inform practical implementation considerations for a larger-scale PSMB deployment – irrespective of which option(s) are decided.

53 Are the network cost elements identified in box 4 relevant for this study? What specific cost items would fall within these categories? What other network costs should be considered? What is the nature and materiality of these (and other relevant) costs under alternative PSMB options?

The cost elements shown in Box 4 are relevant for this study.

Under the operator option, there may be cost-efficiencies derived through equipment co-location in existing operator-owned sites, and synergies may also be achieved in site equipment utilization.

54 What method(s) should be used to estimate the network costs of different deployment options for delivering PSMB? What studies should inform the Commission's thinking in this area?

Ericsson recommends contacting agencies in international markets that have already deployed (or are contemplating deployment) of PSMB. Examples of such entities include: USA LA RICS or Harris County, both of which have deployed PSMB.

55 What network cost components are interdependent with other costs, or other parameters (such as assumptions about the amount of spectrum allocated)? What is the nature of these interdependencies?

The specific spectrum band(s) as well as the quantum of spectrum made available for PSMB will have a direct impact on solution design and device selection, linked to specific cost profiles.

Similarly, the level of resilience specified as well as support and recoverability, coverage area, backhaul selection (fibre/microwave/satellite) and performance KPI's under various scenarios as well as the number of end-users supported during business-as-usual as well as peak users and loads during major incidents will all have an impact on solution design and costs.

56 What data sources could be used to estimate expected PSMB traffic requirements, and the network infrastructure elements required to deliver PSMB capability under different deployment options?

Ericsson recommends seeking feedback directly from PSAs.

57 What data sources could be used to estimate the cost of the infrastructure, equipment and operation in delivering PSMB capability under different deployment options?

Data sources for capex and opex include

- Infrastructure suppliers to telecom operators and PSA's
- Mobile operators and PSA's
- Managed service providers to both operators and PSA's

It should be noted for reference that a high proportion of site costs are directly related to the infrastructure facilities – such as towers and shelters. The actual active infrastructure cost represents a relatively small proportion of the overall site cost (typically 20-25% of the total).

58 What is the appropriate approach (or approaches) to model the opportunity costs of spectrum under different deployment options? What issues does 'spectrum sharing' raise for estimating these opportunity costs, and how might they be addressed?

This question is best addressed by the ACMA.

Regarding spectrum sharing, any cost estimation will have to incorporate factors such as the addressable population / number of addressable subscribers, distribution of this population and average vs peak traffic profiles.

59 What data sources could be used to estimate the opportunity costs of spectrum under different deployment options for PSMB?

This question is best addressed by the ACMA.

60 What is the appropriate discount rate, or range of discount rates, to use in this study?

No comment.

61 How far into the future should costs and benefits be measured?

The rate of infrastructure and solution upgrades for PSMB is dependent on PSA's demand for new features, functionality and capacity. For example, if a particular release (eg 3GPP release 13) had all the relevant features required by PSAs, the network could remain relatively static for a number of years (software and maintenance upgrades excluded).

It is difficult to estimate infrastructure costs beyond 3-5 years due to ongoing technology and capability enhancement.

62 What are the sources of benefits relevant to this study?

Refer to ITU-Recommendation M.2291-0 (12/2013), The use of International Mobile Telecommunications for broadband public protection and disaster relief applications.

63 How can the potential benefits of PSMB capability (in terms of PSA outcomes) be estimated? Is scenario analysis useful? How should scenarios be constructed to reflect an appropriate range of situations faced by PSAs?

Examples of how capability benefits can be estimated include:

- Capability provided 'as a service' – no capex; only opex commitment
- No technology risk / lifecycle to manage
- Simplified / outsourced connectivity and service application level operations
- Service evolution aligned to commercial pace of innovation on network and devices

Scenario analysis, if applied, must also consider the cross-industry benefits as described in response to Question 1.

64 Can you identify any trials or pilot programs of PSMB capability? Are there any insights to draw from these experiences about potential benefits (or costs)?

Examples include:

a Deployment in the USA under the BDOD and now FirstNet program

b Motorola Ericsson Partnership, No1

c Most contracts awarded - 5 contracts out of 7 have been awarded to MSI / E/// Ericsson:

- Mississippi State
- Harris County, Texas
- San Francisco Bay Area, California
- Not disclosed
- Not disclosed

c Largest contract - 190 eNodeB's initially to Mississippi State

d First operational PS LTE contract awarded to Motorola Ericsson by Harris County, Texas, USA

e 90% of all eNodeBs delivered for PS LTE have been delivered by Motorola Ericsson

f Telstra LANES demonstration for G20 (as noted above)

65 Can you identify evidence or examples that illustrate the effects of PSMB capability on PSA outcomes?

Refer to response to Question 64.

66 What method(s) should be used to value the effects of PSMB capability on PSA outcomes?

No comment.

67 Is there research that considers how the costs of responding to natural disasters, crime or other events could be affected if PSAs had access to mobile broadband?

No comment.

Ericsson looks forward to continued engagement with the Productivity Commission on Public Safety Mobile Broadband and digital economy related matters in the future, and is pleased to be contacted in relation to any points raised in this submission.

Yours sincerely,

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